

REMARKS

This response is intended as a complete response to the Final Office Action dated October 31, 2006. In view of the following discussion, the Applicants believe that all claims are in allowable form.

CLAIM AMENDMENTS

Claims 9 and 31 have been amended to more clearly recite aspects of the invention. Specifically, claims 9 and 31 have been amended to recite that the plasma comprises hydrogen, water vapor, oxygen, and nitrogen. In addition, claims 21 and 22 have been amended to correct an inadvertent error in the claimed temperature range. The Applicants submit that these amendments were made for reasons unrelated to patentability and that no new matter has been added.

CLAIM REJECTIONS

A. 35 USC §112 Claim 14

Claim 14 stands rejected under 35 USC §112, 2nd paragraph, as being indefinite for failing to particularly point out and distinctly claim the invention. However, claim 14, which depends from claim 9, has been amended in view of the above-noted amendment to claim 9. Accordingly, the present rejection is moot. In addition, the Applicants submit that claim 14, as amended, complies with the requirements of 35 USC §112, 2nd paragraph and is patentable thereunder. Accordingly, the Applicants respectfully request the rejection be withdrawn and the claims allowed.

B. 35 USC §103 Claims 1-23 and 26-32

Claims 1-23 and 26-32 stand rejected under 35 USC §103(a) as being unpatentable over United States Patent 5,545,289, issued August 13, 1996 to *Chen, et al.* (hereinafter *Chen*) in view of United States Patent 6,652,713, issued May 13, 2003 to *Belyansky, et al.* (hereinafter *Belyansky*). With respect to claims 10 and 32, the Applicants respectfully disagree. Accordingly, the Applicants

have amended claims 1 and 21 to incorporate the limitations of claims 10 and 32, respectively. Claims 10 and 32 have been cancelled without prejudice. Claim 11 has been amended to change dependency from cancelled claim 10 to claim 1.

Chen teaches a process performed on a partially processed substrate 20 having etched metal-containing features 22 and further having etchant byproducts 24, remnant resist 26, and sidewall deposits 27. (*Chen*, col. 4, ll. 45-51.) The sidewall deposits 27 comprise organic compounds containing carbon and hydrogen, metal from the metal-containing layers, such as aluminum, and etchant species such as boron and nitrogen. (*Id.*, col. 5, ll. 16-22.) *Chen* teaches that the exact composition may vary depending upon, *inter alia*, the chemical composition of the metal-containing layers. (*Id.*, col. 5, ll. 22-25.)

However, *Chen* fails to teach or suggest providing an etched substrate having a halogen-containing residue, comprising at least one of chlorine or bromine, formed during etching of a polysilicon layer of the substrate, as recited in claim 1, or providing a substrate having a polysilicon layer on the substrate and etching the polysilicon layer and forming a halogen-containing residue comprising at least one of chlorine or bromine on the substrate, as recited in claim 21. Moreover, *Chen* fails to teach or suggest heating the etched substrate to a temperature of at least 50°C in a gas mixture comprising oxygen and nitrogen, and subsequently exposing the heated substrate to a plasma that removes the halogen-containing residue, as recited in claims 1 and 21.

In the Final Office Action, the Examiner cites Table 1 of *Chen* to allegedly teach a heating step comprising heating the substrate in a gas mixture of oxygen and nitrogen. However, the cited portion of *Chen* shows a gas composition of oxygen and nitrogen from which a plasma is formed for a stripping step during which, in the same process step, the substrate is heated. Accordingly, *Chen* fails to teach or suggest first heating the etched substrate to a temperature of at least 50°C in a gas mixture comprising oxygen and nitrogen, and subsequently exposing the heated substrate to a plasma that removes the halogen-containing residue, as recited in claims 1 and 21.

The Examiner cites *Belyanski* to show etching polysilicon with bromine and removing subsequent bromine etch residue by exposure to an oxygen plasma. However, *Belyanski* fails to teach or suggest heating the etched substrate to a temperature of at least 50°C in a gas mixture comprising oxygen and nitrogen, and subsequently exposing the heated substrate to a plasma that removes the halogen-containing residue, as recited in claims 1 and 21. As such, *Belyanski* fails to teach or suggest a modification to the teachings of *Chen* that would result in the limitations recited in the claims. Therefore, a *prima facie* case of obviousness has not been established as the combination of the cited references fails to yield the limitations recited in the claims.

Moreover, with respect to claims 9 and 31, and all claims depending therefrom, neither *Chen* nor *Belyansky* teaches the claimed process wherein the plasma comprises hydrogen, water vapor, oxygen, and nitrogen. As noted above, *Belyansky* merely discloses removing bromine residue from etching polysilicon with an oxygen plasma. *Chen* discloses removing halogen residues from etching metal-containing layers using a plasma formed from various precursors, such as a hydrogen-containing gas, or ammonia and oxygen, or water vapor alone or optionally with oxygen and nitrogen. (*Chen*, col. 6, l. 45 – col. 7, l. 25.) As such, no combination of *Chen* and *Belyansky* teaches or suggests a plasma comprising hydrogen, water vapor, oxygen, and nitrogen, as recited in claims 9 and 31. Therefore, a *prima facie* case of obviousness has further not been established as the combination of the cited references fails to yield the limitations recited in the claims.

Thus, independent claims 1 and 21, and claims 2-9, 11-20, 22-23, and 24-31, respectively depending therefrom, are patentable over *Chen* in view of *Belyansky*. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

C. 35 USC §103 Claim 25

Claim 25 stands rejected under 35 USC §103(a) as being unpatentable over *Chen* in view of *Belyanski* as applied to claim 21, and further in view of

United States Patent 6,133,102, issued October 17, 2000 to *Wu* (hereinafter *Wu*). The Applicants respectfully disagree.

Independent claim 21, from which the above-rejected claim depends, recites limitations not taught or suggested by any permissible combination of the prior art. As discussed above, the combination of *Chen* and *Belyansky* fails to teach or suggest the limitations recited in claim 21.

The Examiner cites *Wu* to show etching a polysilicon layer using CF₄ in addition to hydrogen gas. However, *Wu* fails to teach or suggest a modification of the teachings of *Chen* and *Belyansky* in a manner that would yield providing a substrate having a polysilicon layer on the substrate; etching the polysilicon layer and forming a halogen-containing residue comprising at least one of chlorine or bromine on the substrate; heating the substrate to a temperature of at least 150°C in a gas mixture comprising oxygen and nitrogen; and exposing the heated substrate to a plasma that removes the halogen-containing residue, as recited in claim 21. Therefore, a *prima facie* case of obviousness has not been established as the combination of the cited references fails to yield the limitations recited in the claim.

Thus, claim 25 is patentable over *Chen* in view of *Belyansky* and further in view of *Wu*. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claim allowed.

NEW CLAIMS

The Applicants have added new claims 35-42 to the application. Claims 35-38 depend from independent claim 1, and claims 39-42 depend from independent claim 21. Accordingly, these claims are patentable at least for the reasons discussed above. More specifically, however, the Applicants submit that no combination of the cited art teaches or suggests a heating step of heating the substrate in a gas mixture of oxygen and nitrogen for a duration of about 10 to about 20 seconds, as recited in claims 35 and 39; providing the gas mixture of oxygen and nitrogen at flow rates of about 5000 sccm of oxygen and about 500 sccm of nitrogen, as recited in claims 36 and 40; providing a gas mixture of

oxygen and nitrogen at an O₂:N₂ flow ratio of about 10:1 during the heating step, as recited in claims 37 and 41; and wherein the substrate is heated at a pressure of greater than about 1 Torr during the heating step, as recited in claims 38 and 42.

The Applicants submit that these claims are supported by the specification and that no new matter has been added. Accordingly, the Applicants respectfully request entry and allowance of these claims.

CONCLUSION

Accordingly, both further consideration of this application and its swift passage to issue are earnestly solicited. If, however, the Examiner believes that any unresolved issues still exist, it is requested that the Examiner telephone Alan Taboada at (732) 935-7100 so that appropriate arrangements can be made for resolving such issues as expeditiously as possible.

Respectfully submitted,

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